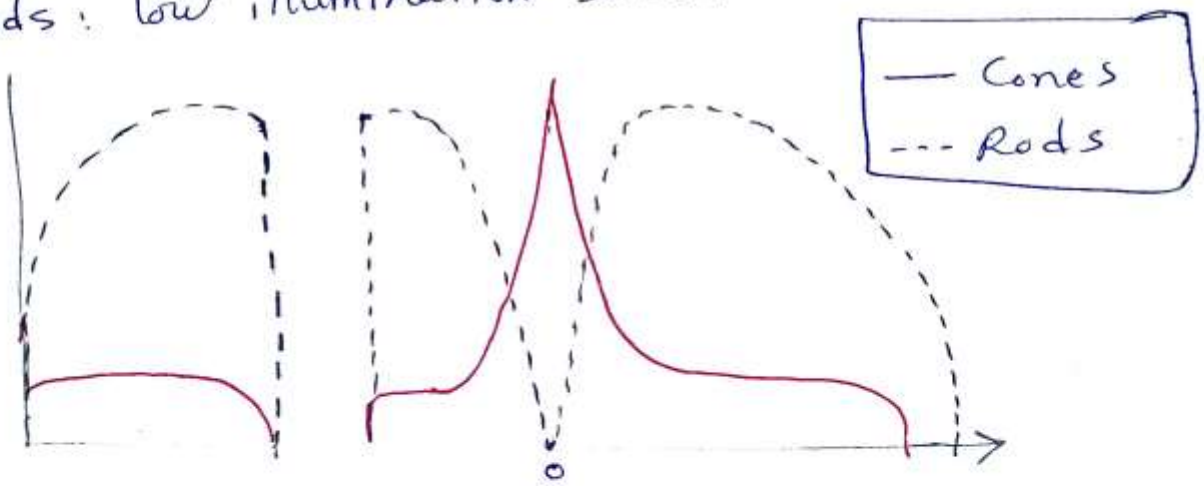
Lec-slide 2

"Human-visual-system-sensors"

* Retina: contain two-types of sensors.

1) Cones: Color sensor

2) Rods: low illumination sensor.



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* Focal-length

→ vary by change lens shape.

→ 14 mm for near object ≤ 3m

→ 17mm for object > 3m.

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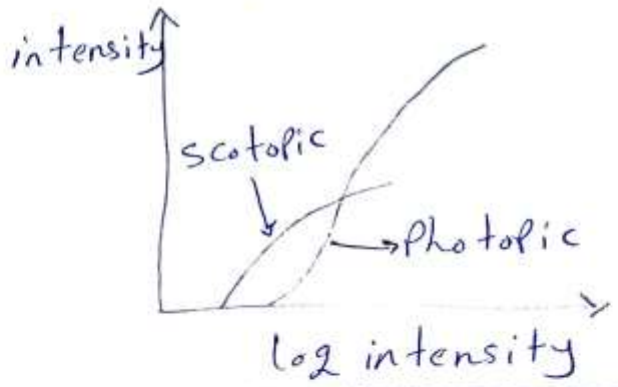
* Brightness-Adaption

→ The range of intensity that human can sense is varying from the scotopic threshold and the Glare limit.

→ the objective brightness is a log function of intensity.

⇒ scotopic vision: low intensity, no-colors.

⇒ Photopic vision: High intensity, colored.



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* Brightness discrimination

→ represent the ability of human to note the change in intensity.

→ varying from person to other.

→ measured with weber ratio: the ratio between ΔI_c "change in intensity that can be detected" and I " intensity of back ground".

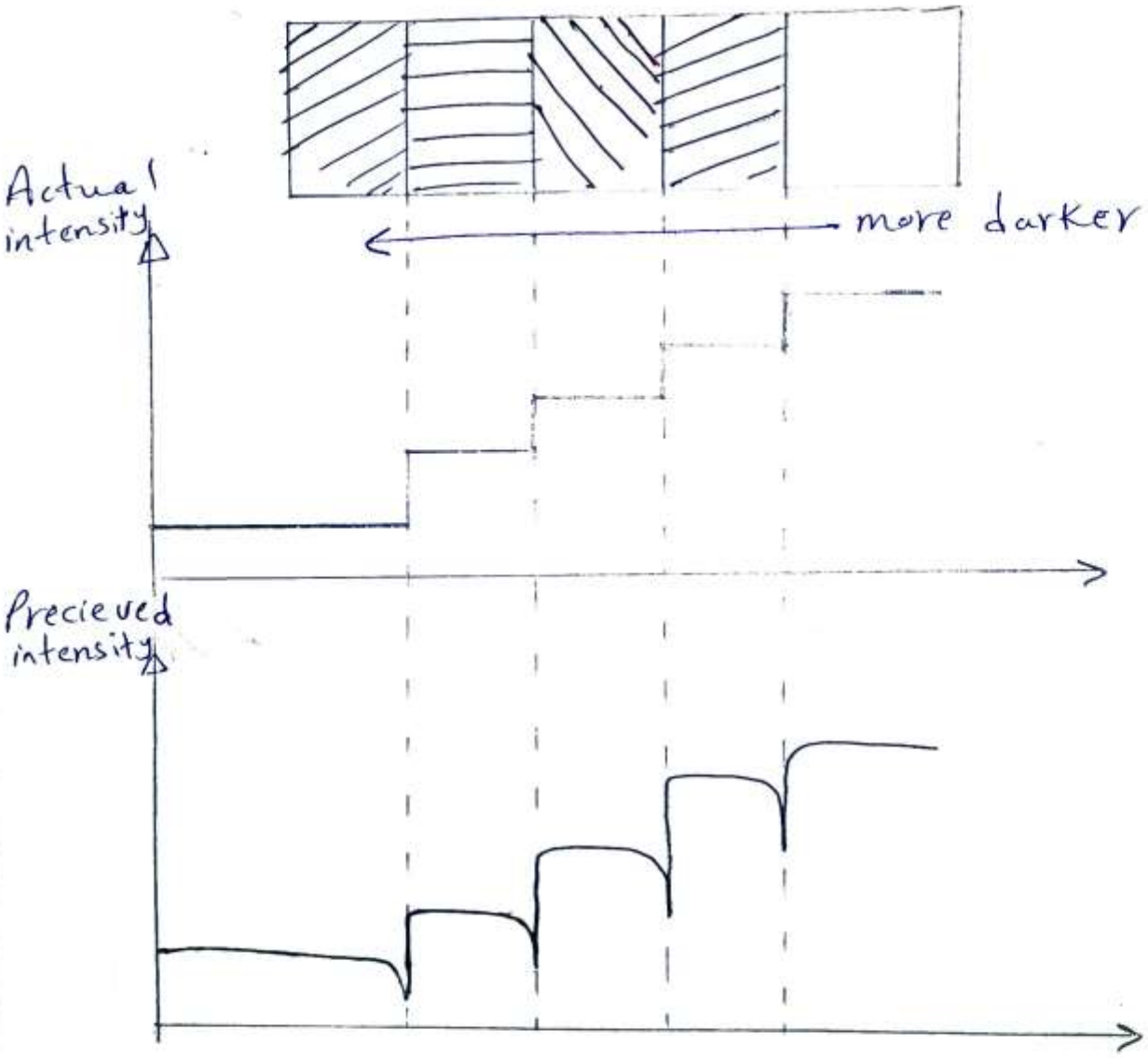
$$\text{weber ratio} = \frac{\Delta I_c}{I}$$

Good discrimination ⇒ Small weber ratio

Bad " ⇒ large weber ratio.

* Brightness is not a simple function of the intensity:

→ the human visual system tends to undershoot or overshoot at the boundary of Mach bands (regions of different intensities).



→ When the background of an object becomes more lighter the object looks more darker.

→ optical illusion.

Electro magnetic waves

h → blank Constant ~~contrast~~

→ Energy $E = h\upsilon$ υ → Frequency

→ wave length $\lambda = \frac{c}{\upsilon}$; c: light speed
↳ $2.998 * 10^8$ m/s

→ to see an object the wave length EM wave used as energy source must be the same ~~or~~ smaller than the object.

Light charcteristics

a) → Mono chromotic (achromotic) not colored
* intensity * gray-levels.

b) chromotic (colored) light
* Radiance. * Brightness * Luminance.

* Radiance: amount of energy flow from light source (watt)

* Luminance amount of energy precieved by observer from light source (Lumen) (lm)

Types of sensors

→ a) single-sensor
↳ resolution depends on the mechanical motion in the ~~both~~ both dimentions.

b) strip-sensor
↳ resolution depends on no. of sensors in one ~~the~~ dimention and the mechanical motion in the other

c) Ring-sensor
↳ used to take 3d image like in CAT.

d) Array sensor
↳ no mechanical motion.
↳ depends on no. of sensors in both dimentions.

Image model

$$0 < f(x,y) < \infty$$

$$f(x,y) = i(x,y) \cdot r(x,y)$$

$$0 < r(x,y) < 1 \quad , \quad 0 < i(x,y) < \infty$$

~~Actually~~

$$L_{min} < f(x,y) < L_{max}$$

$i(x,y)$ illumination

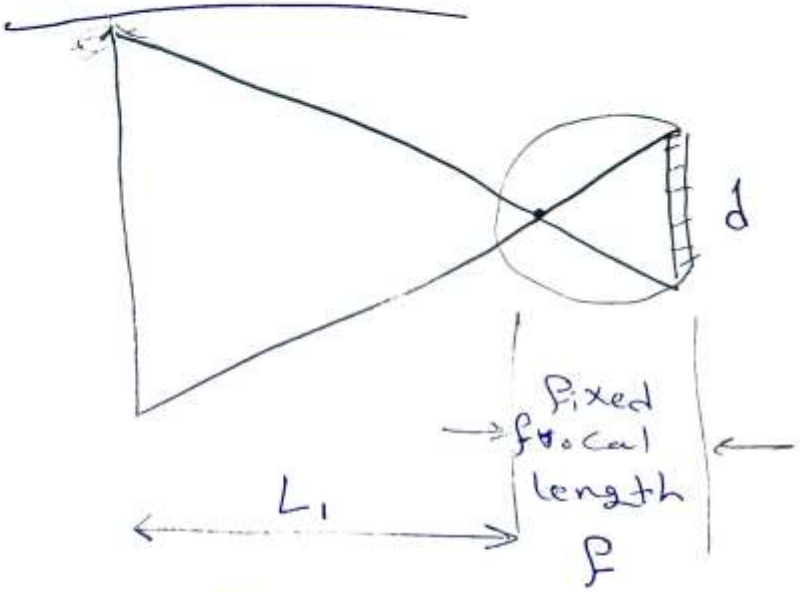
↳ the amount of energy fall on the surface of imaged object (lm/m^2)

$r(x,y)$ reflectance

↳ ability of object to reflect the fallen energy.

Sec 4

Image Processing



$L_1 > 3m$ $\quad f = 17\ mm$

otherwise $\quad f = 14\ mm$

$$\frac{x}{L_1} = \frac{d}{f}$$

Light Sensors

Cones

- → Colored Vision
- need high illumination to work
- → 6-7 million
- → Concentrated.

Rods

- → Colorless vision
- → Can work in low level illumination
- → 25-150 million
- → Distributed.